NASA plans to launch lander-orbiter combinations every two years for the foreseeable future as part of a long-range program to test new technology and to collect scientific data needed before a any human visits can be attempted.

The third lander in the series, scheduled for launch in 2001, will be built out of Pathfinder spare parts. It will carry a rover called the Marie Curie to conduct remote scientific observations and to perfect technology needed for follow-on expeditions. A robot arm on the '01 lander will dig trenches up to a half-meter deep.

"That rover will carry the same instrumentation and perform much of the same function (as Pathfinder's) but by interacting with the lander and the instruments on board the lander, we can make measurements of the rocks directly," said Daniel McCleese, a senior planner with NASA's Mars Exploration Directorate at the Jet Propulsion Laboratory.

Then, in 2003, another, more sophisticated, lander will be launched, this one carrying a rover equipped with instruments rivaling those on current-generation landers. The 2003 rover will feature a complete science lab and a drill to take small core samples from selected rocks. The lander itself will be able to drill more than a full meter down. The idea, McCleese said, is to "collect samples from the interior of rocks so we can get below the chemical and solar weathering that may have occurred on the surface."

"It is a mobile science laboratory, it carries its instruments up to rocks," he said of the 2003 rover. "The rocks are then cored using a small drill that is on the rover. These cores are then taken out of the rock and instruments on board the rover make observations."

The priceless core samples then "are placed into a series of cylinders that effectively cache these samples," McCleese said. "After repeating this operation perhaps as many as 90 times on different rocks and also making observations and collections of soils, the mobile science laboratory moves back to the lander. Then the rover and the arm work together to place the cache of these core samples from the rover into the nose cone of a Mars ascent vehicle. That then places a small capsule containing the samples into orbit."

An artist's impression depicts the Mars Climate Orbiter. Photo: NASA/JPL.

The cache will contain about a half-kilogramme (one pound) of material. It will remain in orbital storage until a mission launched in 2005 arrives. That flight, a joint U.S.-French endeavor, will include an orbiter and lander-rover combination to collect another half-kilogram of soil and rock samples from a different landing site.

"That may not sound like much, but we're now able to do very, very sophisticated analyses with 10 grammes of sample," McCleese said. "So it's a fairly large amount."

Another ascent vehicle will be used to place the 2005 sample cache in orbit. A French-built orbiter then will scoop up the two caches and return them to Earth for detailed laboratory analysis.

"We are joined at the hip now with France in our sample return mission," McCleese said. France will provide a heavy-lift Ariane 5 rocket to boost the 2.5- to 3-metric ton Mars vehicle into space.

"In that partnership France will be a full scientific partner," McCleese said. "It will provide a dedicated Ariane 5 launch in 2005 for the sample return lander, the Mars ascent vehicle, its rover and a French-provided orbiter that actually does the rendezvous with the capsules that NASA's ascent vehicle carries into orbit."

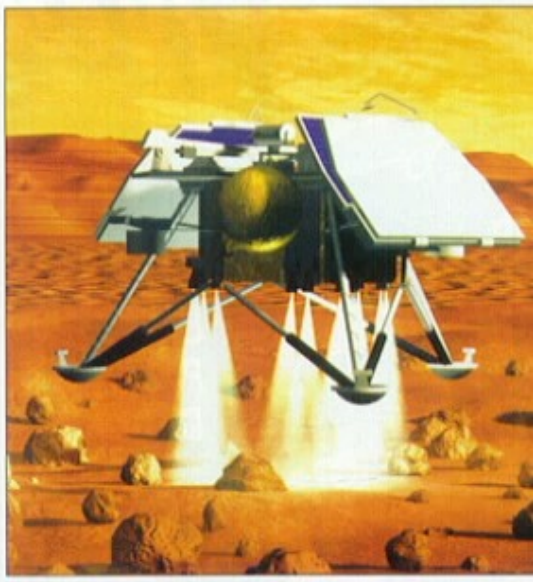
The orbiter will include a NASA canister collection and close rendezvous system.

"But the back end is French, it moves the orbiter about, it contacts with the capsule, the orbiter then sort of ingests the capsules, it closes them up in a sealed bio barrier," McCleese said. "Then the orbiter leaves orbit and sends the capsule back towards the Earth. That whole effort comes back to the Earth and there's a landing without parachutes in the ocean."

Mission through 2005 currently are fully or partially funded by NASA. But additional sample-return flights are envisioned through 2009 and beyond. Along the way, "we may pause, we may realize we're going down a blind alley, we're not finding what we thought we would find, and think about in situ measurements," McCleese said. "We're even thinking about airplanes at Mars to try to get us larger distances away from the landing sites."

A small glider, for example, could be deployed as a lander descends under its parachute. Even better, a motor-driven plane could fly for an entire day, getting up to 200 kilometres (124 miles) from the landing site. Such robotic aircraft would be "capable of building up a picture of, for example, stratified canyon walls," McCleese said. "Or maybe if we find something that looks like an old hydrothermal system on the surface, exploring the environment around that."

Planners at the Jet Propulsion Laboratory in Pasadena, California, are



The Mars Polar Lander touches down in this artist's impression. Photo: NASA/JPL.

even exploring the possibility of blasting out craters with robotically placed "clean" explosives so rovers could gain access to a wider variety of subsurface material.

The long-range goal, of course, is to send humans to Mars, possibly as early as 2013 or 2015. While robotic landers and orbiters will continue to grow in capability and sophistication, engineers believe humans will be needed to carry out field geology and to do the deep drilling necessary to find liquid water.

"There are certain things we're waiting for humans to do, that there just doesn't seem to be an obvious way to do it with robots," McCleese said. "An example would be drilling down to depths where we believe there may still be liquid water on Mars, about a kilometre or maybe two. With robots we search for the closest extent to the surface where the water might be, shallow drilling from the rovers, one meter to five meters.

"A robotic exploration that carries and oil derrick seems like a big stretch," he continued. "But if you've already got humans going, they're already providing an infrastructure where drilling might be possible."

Asked what human astronauts bring to the table that robots cannot match even in theory, McCleese pointed to judgment and the human eye.

"They bring field geology, the kind of geology that people do walking around, trying to understand Earth geology," he said. "If you get to the point where you have humans there, they can do a thorough evaluation of the environment, they can take samples based on what they're seeing. And with a minimum of about a 20-minute delay time in round-trip communications, that's not so easy to do with robots."

William Harwood has covered the U.S. space programme for more than a decade. He is a consultant for CBS News and writes for *The Washington Post* and *Space News*.

8-3-2002

Ufo, esperti del mondo a San Marino

Due convegni sulla vita nel cosmo

Esiste altra vita nel cosmo? E' per fare il punto sulla ricerca delle intelligenze extraterrestri che a San Marino si sono radunati i massimi esperti del settore, provenienti da tutto il mondo. Due i dibattiti che si incrociano, dalla mattina di venerdì 8 marzo al pomeriggio di domenica 10, nella cornice del Teatro del Turismo. Le conferenze sono aperte a tutti, con ingresso gratuito.

Si comincia con il terzo simposio mondiale su "Esplorazione dello spazio e la vita nel cosmo", che quest'anno ha come tema *Euroseti: intelligenze extraterrestri dal Seti al Setv*. A seguire, il decimo simposio mondiale su "Oggetti volanti non identificati e i fenomeni connessi" intitolato: *Ufo, ufologia e riconoscimenti istituzionali*.

Al centro del primo dibattito, il ruolo dell'organismo americano **Seti** (*Search for extraterrestrial intelligence*), che si va sviluppando sempre di più, rivolgendosi a tecniche e strategie nuove: fra queste, la ricerca di possibili visite extra-terrestri (**Setv**, *Search for extra-terrestrial visitation*). Intervengono vere e proprie autorità del settore, scienziati e astrofisici che hanno studiato il fenomeno Ufo anche livello militare e governativo.

Nomi di spicco relazionano anche nel secondo simposio: **Vincente Olmos**, che ha collaborato con l'Aeronautica spagnola, il fisico **Auguste Meessen** e **Richard Haines**, rispettivamente consulenti dell'Aeronautica belga e statunitense, che presentano il frutto delle loro ricerche.

invia ▲ indietro

returned will be 50 times more detailed than those obtained from previous X-ray missions.

Mars missions underway

NASA successfully launched a pair of probes to Mars in December and January.

The Mars Climate Orbiter lifted off from Cape Canaveral Air Station in Florida on December 11 and was followed three weeks later on January 3 by the Mars Polar Lander. Both probes were placed *en route* to the Red Planet by Boeing Delta 2 rockets.

The Climate Orbiter will begin circling Mars in September and the lander is due to touch-down on the edge of the Martian south pole on December 3.

• See pages 16-17 for further details.

The Mars Polar Lander blasts off from Cape Canaveral in a cloud of rocket exhaust on January 3. Photo: NASA/KSC.

AS TODAY NOW 2-1-99

John Bonr/Gemini Station

Anello di rilievi terrazzati sito in Acidalia Planitia (33° N, 23° O) del diametro di circa 40 km. L'anello rappresenta probabilmente il bordo di un antico cratere d'impatto quasi completamente distrutto da processi di erosione e sedimentazione.

al computer per capire come, per esempio, lo spettro di un pezzo di roccia di una data sostanza, misurato in laboratorio ad alta temperatura, si possa modificare quando lo stesso minerale si trova alle basse temperature di Marte ed è sovrastato da un'atmosfera dalle stesse caratteristiche chimiche e fisiche di quella marziana. Nonostante queste complicazioni, si può comunque affermare che, almeno in linea di principio, l'individuazione di una data specie mineralogica tramite tecniche di telerilevamento avviene nel modo che abbiamo descritto.

Nell'Università di Lecce la ricerca in questo settore, iniziata qualche anno fa con la progettazione e la realizzazione dello spettrometro PFS, procede in due direzioni. Da un lato continuiamo a cercare aree della superficie marziana che mostrino strutture geologiche indicative della possibile esistenza di un antico lago o mare e che quindi possano essere costituite da carbonati. In altre parole, scegliamo le aree della superficie di Marte che sembrano più promettenti per l'individuazione di depositi carbonatici. Dall'altro, tramite analisi di laboratorio e simulazioni al calcolatore, cerchiamo di ottenere, in diverse condizioni fisiche, spettri di emissione di varie sostanze carbonatiche (in particolar modo calcaree), da confrontare in un prossimo futuro con gli spettri delle aree marziane da noi selezionate, ottenuti con il PFS.

Se, come speriamo, riuscissimo effettivamente a individuare cospicue quantità di carbonati su Marte (una ricerca del genere è prevista anche nel programma della missione americana Mars Global Surveyor attualmente in orbita attorno a Marte), compiremmo innanzitutto un importantissimo passo verso la prova definitiva che in passato il clima del pianeta era realmente molto diverso da quello attuale. Una volta individuati i depositi, si tratterà poi di verificare, tramite misurazioni *in situ*, se per caso tali depositi non abbiano un'origine biologica, il che proverebbe che un tempo Marte ospitò elementari forme di vita, come suggerito da alcuni ricercatori della NASA nell'estate dell'anno scorso. Evidentemente, se le cose stessero davvero così, ciò aprirebbe delle prospettive estremamente interessanti non solo per la comunità scientifica ma per tutto il genere umano.

Ma a questo punto è bene fermarsi per non cedere alla tentazione di spingersi troppo in là nel campo delle ipotesi.

L'autore ringrazia Stefano Solazzo per l'elaborazione delle immagini Viking.

VINCENZO OROFINO, nato a Lecce nel 1955, si è laureato in Fisica all'Università di Lecce e ha conseguito il Dottorato di Ricerca in Fisica all'Università di Bari. Attualmente è ricercatore presso il Dipartimento di Fisica dell'Università di Lecce. Nell'ambito della missione russa Mars 96 si è occupato della scelta dei siti da osservare con lo spettrometro PFS alla ricerca di depositi carbonatici.

(sopra) Immagine della regione (20° N, 73° O) dove il canale di deflusso Kasei Vallis, largo in questo punto circa 15 km, forma una doppia ansa. L'acqua che ha scavato il canale proveniva dalla regione in basso a sinistra e fluiva verso l'area in alto a destra con un andamento dettato dalla pendenza del terreno. (*ove non altrimenti specificato, le immagini sono del Viking Orbiter; NASA*) Si noti l'isola (a) dalla caratteristica forma allungata. In alcuni punti (b) il corso è più inciso nel terreno rispetto ad altri tratti (c), probabilmente a causa della maggiore turbolenza dell'acqua in quei punti e/o della maggiore erodibilità del terreno.

(sopra) Particolare della regione di origine del canale di deflusso Shalbatana Vallis (0° N, 46° O). La depressione circolare, di diametro pari a 100 km, si deve essere originata quando il *permafrost* venne sciolto dall'attività vulcanica, facendo crollare il terreno sovrastante. Ciò fece affiorare violentemente l'acqua che scavò il canale scorrendo impetuosamente verso nord-est (in questa immagine, come in tutte le altre, il nord è verso l'alto). Si noti al centro della depressione l'estesa area di terreno fratturato e altamente irregolare che viene chiamato terreno caotico. Molti canali di deflusso si originano da aree di questo tipo. L'immagine a grande campo della pagina a fronte, in cui sono indicati i particolari ripresi qui sopra, è tratta da *The NASA Atlas of the Solar System*.

MARTE, IL QUARTO PIANETA DEL SISTEMA SOLARE in ordine di distanza dal Sole, è circa due volte più piccolo della Terra (il suo raggio equatoriale è di circa 3400 km) con una massa pari a un decimo di quella terrestre. Il pianeta è molto freddo con una temperatura media di −55 °C. All'equatore durante il giorno le temperature estive possono raggiungere i 25 °C (arrivando in casi eccezionali fino a 37 °C), ma cadono di 100 °C o più durante la notte, a causa della mancanza dell'azione equilibratrice degli oceani e dell'atmosfera. Ai poli, invece, in entrambi gli emisferi le temperature invernali possono scendere molto al di sotto di −128 °C.

L'atmosfera, costituita quasi esclusivamente di anidride carbonica, è molto tenue ed esercita al suolo una pressione minore di 1/100 di quella terrestre; anche la pressione parziale del vapore acqueo è di gran lunga minore di quella terrestre. Questo fatto, unito alle basse temperature, ha per conseguenza che l'acqua non può esistere allo stato liquido su Marte, in quanto, appunto, essa solidifica e poi sublima molto rapidamente (tranne che ai poli dove il ghiaccio è relativamente stabile). In effetti Marte presenta oggi una superficie molto secca ed estremamente fredda. Anche la pioggia e la neve sono di fatto impossibili. Quindi, attualmente il pianeta è un gelido deserto. Tuttavia è probabile che Marte non sia stato sempre caratterizzato da questo clima rigido e secco, ma che in passato la pressione atmosferica e la temperatura al suolo avessero valori sufficientemente alti da permettere la presenza di acqua allo stato liquido sotto forma di fiumi, laghi e forse anche oceani. Vediamo quali osservazioni suggeriscono quest'idea.

UNO DEI RISULTATI PIÙ NOTEVOLI della missione Mariner 9 del 1971 fu la scoperta di parecchi canali, cioè solchi incisi nel terreno, che sembrano essersi formati in un lontano passato per l'attività di qualche forma di acqua corrente. Occorre subito precisare che queste strutture non hanno niente a che vedere con i famosi "canali" che verso la fine del secolo scorso l'astronomo Schiaparelli pensò di aver scoperto sulla superficie del pianeta e che si sono rivelati invece semplici illusioni ottiche. Infatti, al contrario di questi ultimi, che si credeva attraversassero tutto il pianeta seguendo percorsi quasi perfettamente rettilinei, i canali fotografati dal Mariner 9 e successivamente dai Viking (la cui missione durò dal 1976 al 1982) presentano andamenti irregolari, con sinuosità più o meno accentuate, e sono meno lunghi.

I canali possono essere classificati a seconda della morfologia e delle dimensioni. Un importante gruppo è costituito dai cosiddetti *canali di deflusso*, quale a esempio la Kasei Vallis. Questi sono in genere molto grandi (larghezza massima intorno ai 100 km, lunghezza fino a 2000 km) e hanno spesso profondità maggiori di un chilometro. Al contrario dei fiumi terrestri, essi generalmente non hanno tributari (oppure ne hanno pochissimi) e hanno un'ampiezza iniziale già molto grande, confrontabile con quella che si misura alla fine del loro

50 GREATEST INVENTORS

actually solve any problem thrown at it. He hit on his revolutionary idea while working on a huge calculating machine for the British government during the 1830s – the so-called Difference Engine – which was never completed (an unfinished portion now sits in the British Science Museum, London). He didn't finish his futuristic mechanical computer – the Analytical Engine – either, but simply thinking up such an ambitious machine was itself a huge achievement. Babbage has a raft of other inventions to his name, including the speedometer, skeleton keys and cow-catchers on the front of trains.

8 Guglielmo Marconi: Radio communication

(1874 - 1937)

Although other scientists were experimenting in wireless communication before him, it was Marconi who had the drive and ingenuity to turn radio into one of the key technologies of the 20th Century. He began at the age of 20, after reading about a German scientist who'd sent waves of electromagnetism across empty spaces. Within a year, Marconi had converted them into electricity and was sending and receiving the signals over 1.5 miles. Soon after he took out took out a patent. Incredibly, the Italian government wasn't interested, but the British were, and Marconi went on to develop short-wave radio equipment and established a worldwide radio telegraph network for the government. By 1901, he had sent Morse code from Cornwall to Newfoundland, making him the pioneer of global communication.

7 Nikola Tesla: The Tesla Coil

(1856 - 1943)

Can't name a Serbian inventor? You can now. Tesla arrived in America in 1884 virtually penniless, but with a clever idea: alternating current (AC) electricity. Better suited to large-scale power generation than Edison's rival direct current system, AC needed dynamos and generators if it was to succeed. Tesla invented them, and sold the patents to Westinghouse. He later became fascinated by sending electric power through thin air using electromagnetic radiation.

6 Tim Berners-Lee: The Internet

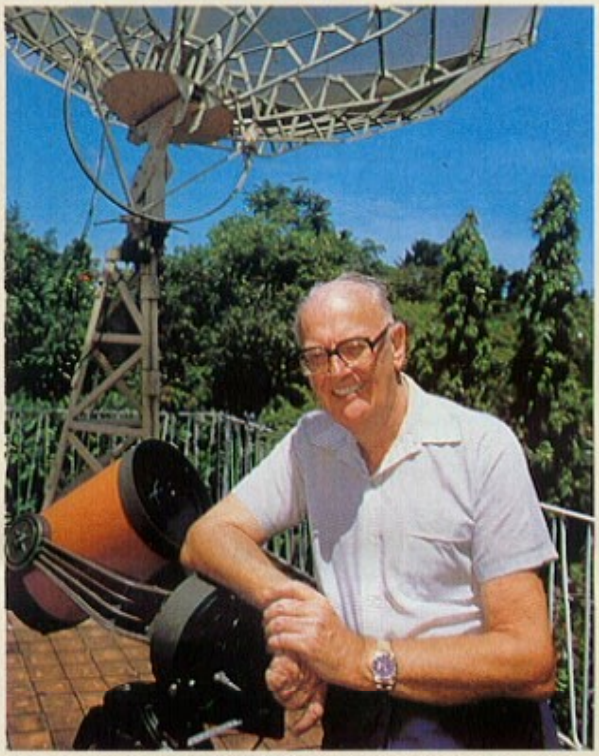
(born 1958)

While working at the European particle physics research centre CERN in Geneva, former Plessey engineer Berners-Lee invented a simple way for physicists across the world to swap research reports down telephone lines. His inspiration was a Victorian book called *Inquire Within: Anything You Want To Know*, supposedly a collection of every known fact. Berners-Lee's electronic version, launched in 1989, became the World Wide Web.

Interview

Arthur C Clarke: Living Legend

The most influential science fiction writer/inventor ever talks to *Focus* about space, the Net, artificial intelligence and life on Europa... By Sean Blair



Author and inventor Arthur C Clarke at his home in Sri Lanka

His voice booming out of a phone speaker direct from Sri Lanka – the Indian Ocean island where he has made his home for the last 40 years – the scientist and author, Dr Arthur C Clarke, sounds younger than his 79 years. He's come a long way since his rural Somerset boyhood: by 1945 he had already invented the concept of geostationary communications satellites (in tribute, that particular orbit is known as the Clarke Belt) and worked on a plan to put men on the moon.

His writing has been just as influential as his inventions. The designer of the World Wide Web, Tim Burners-Lee, cites Clarke's short story *Dial F For Frankenstein*, about a communications network that develops self-awareness, as a key influence.

Clarke's new novel, *3001*, has a host of new predictions. But what is he most looking forward to in the next few years?

The energy revolution

"Surviving, I suppose," says Clarke. "At the moment I'm not sure I'm going to make it. I've got a chest infection that drains my energy just as I'm getting more demands on my time. Apart from that, I'm 90 per cent sure that the energy revolution is starting and the fossil fuel era is ending.

"That's because of so-called cold fusion – which is seldom cold and probably isn't fusion. The first commercial firms are being launched with plenty of money behind them, there's a lot of material on the Net about it, and the first kits are going on sale from companies like CETI."

Clarke believes 'cold fusion' experiments are actually tapping into zero-point energy, created by subatomic particles blinking in and out of existence, although proof of this is yet to be found.

Though comprehensively wired, Clarke spends surprisingly little time on the Web. "I've only seen small bits of it myself; life's too short to find the right site. I once typed up 'Clarke' on the Web, got 100,000 hits and gave up in despair!

"It's a kind of electronic immortality, but I'm already 50 light years into space, because of the BBC TV programmes I did from Alexandra Palace."

I've seen more in my lifetime than I ever dreamed I would

Clarke remains fascinated by the digital revolution. He's addressing the heads of Asian nations in December about how their countries will benefit from it. He considers his generation of sci-fi writers failed even to imagine the vast impact of the personal computer.

"There must be around 10 computers to every human being on earth – it might even be as high as 100.

"I'm sure we'll get some form of artificial intelligence eventually, maybe not in 2001 but by 2101. Our successors will be artificial intelligences of some kind, I just hope they treat us well."

Road to Europa

As a founder member of the British Interplanetary Society, Clarke was closely involved in early space projects. Would his younger self be amazed or disappointed by what has been achieved so far?

"Amazed, definitely. I've seen far more in my lifetime than I ever dreamed – to even see men on the moon in my lifetime is incredible, let alone stunning close-ups of all the planets in the solar system.

"Maybe I shouldn't mention this," he says, "but there's one Galileo image from Europa that everyone's puzzling over, frame 00588, which shows an absolutely straight line 200 kilometres long. Nobody can really understand it. I won't speculate, except to say that it's at least a mile wide. Perhaps the Europans are big!"

Four page guide to European AstroFest '99

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Life on Mars controversy

NEXUS - n° 37

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NEXUS IN FIERA

(Milano, 22-24 marzo 2002)

Continua il «tour» fieristico di Nexus. Anche quest'anno saremo presenti con il nostro stand dal 22 al 24 marzo all'«Exposalute» di Milano. La fiera milanese propone una panoramica completa su tutti gli aspetti riguardanti il benessere e la salute: le novità in tema di terapie naturali, omeopatia, fitoterapia, agopuntura, alimentazione biologica, bioedilizia, arredamento e abbigliamento ecologico. Nutrito il programma di incontri scientifici e divulgativi. Prevista un'area per check-up gratuiti funzionante durante tutti i tre giorni. L'ingresso all'Exposalute è gratuito. Per informazioni, richieste o appuntamenti con la redazione di Nexus: tel.-fax 049/9115516, e-mail info@nexusitalia.com.

UFO, UFOLOGIA E RICONOSCIMENTI ISTITUZIONALI

(1° simposio mondiale, Rep. di San Marino, 8-9-10 marzo 2002)

Torna per il decimo anno consecutivo il simposio mondiale di San Marino sugli oggetti volanti non identificati e i fenomeni connessi. Si terrà dal 9 all'10 marzo prossimi al Teatro Turismo, con alcuni fra i massimi esperti mondiali a convegno sul tema «Ufo, Ufologia e riconoscimenti istituzionali». «La costituzione di enti istituzionali di studio e ricerca sugli Ufo in Nord e Sud America ed Europa - si legge nella premessa del simposio - suggerisce la costituzione di strutture analoghe in ambito italiano». L'ingresso è libero.
La manifestazione, coordinata da Roberto Pinotti e organizzata dall'Ufficio di Stato per il Turismo in collaborazione con Cun e Crovni, è abbinata anche quest'anno al simposio mondiale sulla colonizzazione dello spazio e la vita nel cosmo (tema: «Euroseti: Intelligenze extra-terrestri dal Seti al Setv») che lo precederà immediatamente nei giorni 8 e 9 marzo, sempre al Teatro Turismo. «Il ruolo del Seti - è la linea del convegno organizzato con la Seti League e la Planetary Society - si va sviluppando sempre di più, rivolgendosi a tecniche e strategie nuove: fra queste la ricerca di possibili visite extra-terrestri». Questi gli orari della «tre giorni» di simposi: venerdì 8 marzo 9-13, 15-18 e 21-23,30; sabato 9 marzo 9-13 (simposio Seti), 15-19 e 21-23,30 (simposio Ufo); domenica 10 marzo 9-13 e 15-18. Per informazioni, tutti gli interessati possono rivolgersi all'Ufficio di Stato per il Turismo di San Marino, tel. 0549/882412-fax 0549/882575- E-mail statoturismo@omniway.sm.

L'UOMO E IL MISTERO

(10° convegno internazionale, Riccione, 23-28 aprile 2002)

Da ormai dieci anni si svolgono a Riccione i convegni «L'uomo e il mistero» promossi dalla Edizioni Mediterrannee. Per festeggiare in maniera adeguata l'evento - fanno sapere gli organizzatori - è stato predisposto quest'anno un programma particolarmente ricco di stimoli e contenuti: un maggior numero di seminari di uno o due giorni, nuove tematiche spazianti in tutti i campi della ricerca psichica, graditi ritorni, ampio spazio dedicato all'esperienza diretta e al coinvolgimento del pubblico. In pratica una «cinque giorni» della ricerca psichica, introdotta da incontri e seminari con sensitivi, che avrà il suo «clou» nel convegno internazionale di venerdì 26, sabato 27 e domenica 28. Per informazioni, e per ricevere il programma definitivo e dettagliato, rivolgersi alle Edizioni Mediterranee, via Flaminia 109 - 00196 Roma - tel. 06/3235433 - fax 06/3236277 - e-mail info@ediz-mediterranee.com o alla coordinatrice del convegno, Paola Giovetti, via Archirola 33 - 41100 Modena - tel. 059/306746.

LE VIE DELLA SALUTE E DELLA CONSAPEVOLEZZA

(Incontri, Casalecchio di Reno 2002)

Proseguono i «venerdì» di educazione alla salute promossi dal Comune di Casalecchio di Reno in collaborazione con il Centro Orientamento Salute (Cos) di Andromeda e Cartaduemila. Il ciclo di serate 2002, iniziato in gennaio, è articolato in 15 appuntamenti che si terranno tutti alle ore 20,30 nel Centro Giovanile di Casalecchio in via dello Sport. Questi i temi e i relatori delle prossime serate: 1 marzo «Approccio osteopatico» di Andrea Raggi; 8 marzo «Ricerca diagnostica» di Heinrich Kremer; 15 marzo «Il test diagnostico sonoro» di Nello Andreoli; 22 marzo «Metodi diagnostici e autismo» di Roberto Simonetti; 29 marzo incontro... a sorpresa; 5 aprile «C'era una volta il bambino» di Efrem Satanassi; 12 aprile «Diagnosi differenziale energetica sistemica post-reichiana» di Giorgio Bicci e Beatrice Casavecchia; 19 aprile «La diagnosi medianica» di Valeria Ghelli. Chiuderà il ciclo di incontri il 26 aprile «Screening: disinformare per convincere» con Gianfranco Domenighetti e Beppe Grillo. Coordineranno e modereranno i dibattiti Paolo Brunetti e Antonio Papa. Per informazioni rivolgersi a Miriam Masi dell'Ufficio «Progetto Città Sane» (tel. 051/598274/5 - fax 051/6132532). La partecipazione alle conferenze è gratuita.

DR KREMER IN ITALIA

(seminario di formazione, Ozzano dell'Emilia, 9-12 marzo 2002)

Si svolgerà dal 9 al 12 marzo prossimi a Ozzano dell'Emilia, promosso dalla Macro Edizioni, un seminario di formazione per medici e terapeuti condotto dal Dr. Heinrich Kremer. Scopo principale del corso è comunicare l'esperienza del Dr. Kremer nel campo del trattamento clinico del virus dell'HIV e dell'Aids a un gruppo di medici e a terapeuti in grado successivamente di offrire un aiuto concreto ed efficace alle persone etichettate come sieropositive. La sintesi delle sue ricerche afferma che tutti i sintomi Aids si possono spiegare come uno squilibrio endogeno trattabile con medicine non tossiche e che, soprattutto, non rappresenta una «minaccia mortale incurabile» da alleviare con medicinali tossici ritenendo che sia il male minore.
Il seminario si terrà nell'Agriturismo Dulcamara e si avvalerà della presenza di traduttori professionisti.
Per informazioni: Macro Edizioni,
tel. 0547/346290 - fax 0547/345091, E-mail:direzione@macroediz.oni.it

I MISTERI DI MONTEVECCHIA

(serate di studio, Montevecchia, marzo-aprile 2002)

Si parla di misteri anche a Montevecchia (Lecco) dove dal mese scorso ha preso il via un interessante ciclo di serate, organizzato dalla Pro Loco e dal suo presidente Vittorio Di Gregorio, e improntato alla controinformazione. In particolare, il 2 marzo si parlerà dei reperti «fuori posto» dell'archeologia ufficiale, con riferimento anche a quelli scoperti in Italia. Il 16 marzo serata monografica su Rennes Le Chateau e le sue implicazioni sulla religione e sullo sviluppo degli ordini Templari, Albigesi, Catari, etc. Il 6 aprile, in collaborazione con il Centro Ufologico di Lecco, si parlerà di Ufo, Marte e Cerchi nel grano. Il 20 aprile serata sui simboli esoterici e decifrazione dei messaggi criptati che si possono osservare sulle facciate delle nostre cattedrali (esaminate Bergamo, Como, Cremona) in equilibrio tra religione e paganesimo e sulle influenze avute sui Templari e sull'ordine dei «muratori». Il 4 maggio, serata conclusiva, si cercherà di sondare tutte le teorie esistenti sull'origine della razza umana (evoluzionismo-creazionismo). Le serate di studio si tengono alle 21 nella casetta-bi (zona campi sportivi) di località Quattro Strade a Montevecchia.
http://www.prolocomontevecchia.it/COME%20ARRIVARCI.htm

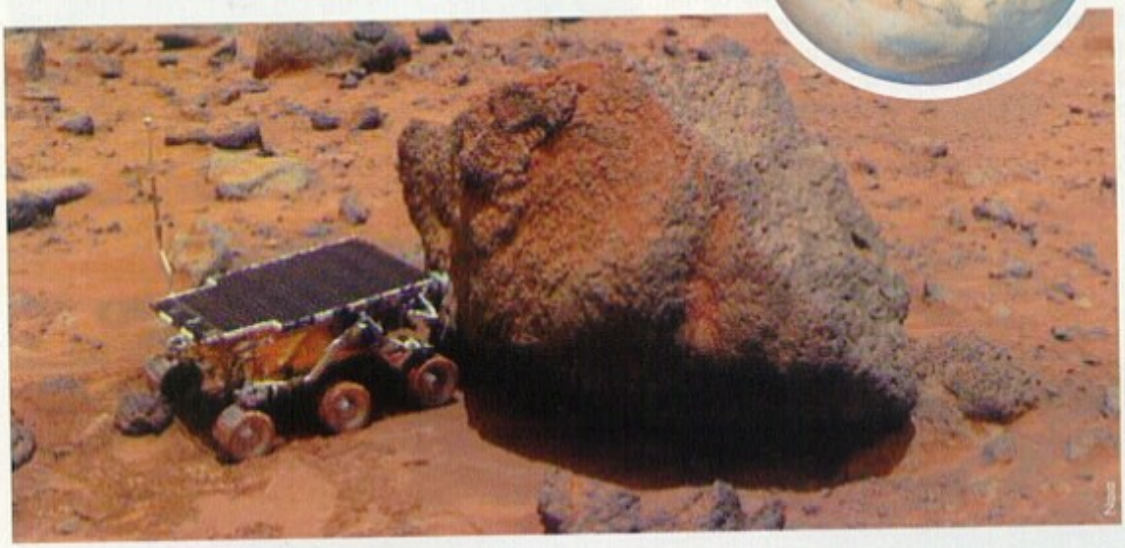
GRAFO-PSICOLOGIA ESOTERICA

(seminari di studio, Padova, 2002)

Alfonso Rubino tiene degli interessanti seminari di grafo-psicologia esoterica a Padova e altrove. Questi seminari si occupano dell'analisi della scrittura come atto di azione-movimento di un' organismo vivente. In essa si prefigura l'esistenza di un nuovo tipo di energia, a cui viene dato il nome di psinergia, che e' possibile misurare come una normale grandezza fisica. La psinergia sembra essere un indicatore dell'azione intelligente che guida il comportamento delle forme viventi. Chi fosse interessato a partecipare, o organizzare un seminario, puo' contattare Alfonso Rubino ai seguenti numeri telefonici: 049/615617 e 347/5051940.

Les événements 97 de l'année

Les premiers tours de roues sur Mars

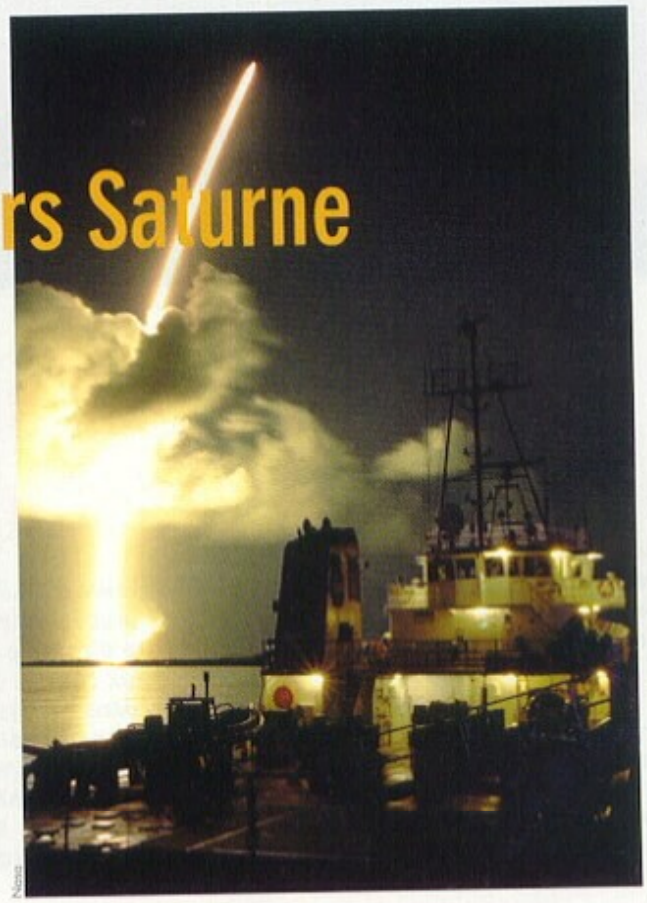


Vingt et un ans après l'exploit des sondes Viking, les États-Unis retournent sur la planète Mars. En fanfare, pile à l'heure pour célébrer la fête nationale américaine, ils réalisent une spectaculaire démonstration de puissance en laissant des empreintes de roues dans la poussière martienne. À l'origine, Mars Pathfinder est une mission d'ingénieurs, une expérience technologique chargée de tester la faisabilité de nouveaux programmes scientifiques "petits, rapides et pas chers". En offrant son premier panoramique martien sur Internet et en caracolant avec Sojourner de "Barnacle Bill" en "Scooby Doo", la Nasa réussit le double exploit de rassembler chercheurs et grand public autour d'un grand défi : explorer la planète rouge. L'Europe rentrera-t-elle dans la course ?

Les événements 97 de l'année

Cassini-Huygens

En route vers Saturne



Le dernier grand vaisseau d'exploration du Système solaire est parti. Son objectif : le monde de Saturne au... XXIe siècle. Une planète géante, un étonnant système d'anneaux, et dix-huit satellites : voici la destination finale de la mission Cassini-Huygens, une expédition américano-européenne placée dans l'espace le 15 octobre dernier par une fusée Titan 4. Vénus, la Terre et Jupiter seront utilisées par les navigateurs spatiaux comme frondes pour accélérer le vaisseau qui rejoindra l'orbite de Saturne le 1er juillet 2004. La sonde européenne Huygens, elle, sera précipitée quelques mois plus tard dans l'atmosphère de Titan, la plus grosse lune du système. Pendant quatre ans, Cassini explorera en profondeur les mondes saturniens, là où les sondes Voyager n'étaient restées que quelques heures.

filmer les débris expulsés. Puis, le 19 octobre, Anatoli Soloviev et Pavel Vinogradov ont revêtu leur scaphandre pour s'introduire dans Spectre et reconnecter les câbles du panneau solaire. Un demi-succès selon les Russes : une partie seulement des connexions nécessaires à l'alimentation de la station a pu être réalisée. Il reste surtout à tenter le colmatage de la fissure, ce qui fera l'objet de nouvelles sorties dans l'espace. ■

Mars Pathfinder, c'est la fin

Mars Pathfinder ne répond plus. À l'exception d'un dernier signal très faible, capté le 7 octobre, les ingénieurs du JPL n'ont plus reçu de données en provenance de la petite station

La sonde martienne et son rover, qui avaient débuté leur mission le 4 juillet, sont désormais muets.

depuis le 27 septembre. Même silence obstiné de la part du robot Sojourner. Les responsables de la mission avaient décidé d'attendre jusqu'au 4 novembre avant de renoncer définitivement. Selon toute probabilité, c'est le froid qui a eu raison de Mars Pathfinder, la température oscillant désormais entre – 50 °C et – 30 °C. La sonde martienne et son rover s'étaient posés sur la planète rouge le 4 juillet dernier. ■

brèves

● **ENFIN :** Le Français Léopold Eyharts partira pour Mir fin janvier. Sa mission avait été retardée par les pannes de la station russe. L'Américain Andrew Thomas aura, quant à lui, rejoint Mir quelques jours plus tôt à l'occasion d'un vol de la navette Endeavour.

● **ŒUF :** Les mesures interférométriques réalisées avec le senseur de guidage fin d'Hubble indiquent que les étoiles R Leo et W Hya sont de forme ovoïde. Leur plus grand diamètre est supérieur de 11 à 20 % à leur petite dimension.

● **CHAUD :** Durant un peu moins d'une seconde, le point le plus chaud de la planète a été un plasma confiné au laboratoire de Culham dans l'Oxfordshire. L'expérience JET, exploitant la fusion du deutérium et du tritium, a abouti à la libération de 12 MW d'énergie.

● **ÉQUITÉ :** La composition des quatre premiers équipages américano-russes qui arriveront à bord de la station internationale est connue. Les quatre commandants — William Sheperd, James Voss, Daniel Bursh et Kenneth Bowersox — sont américains.

● **CONCOURS :** L'université internationale de l'espace et l'académie de Strasbourg

Les écoliers alsaciens ont jusqu'à mai 1998 pour proposer leurs expériences spatiales.

ouvrent un concours s'adressant aux écoliers de la région Alsace. Il permettra aux lauréats d'embarquer une expérience scientifique sur un vol de la navette américaine. La sélection des dossiers s'effectuera en mai 1998.

● **DÉSILLUSION :** Le budget civil demandé par la Nasa pour 1999 est de 12,6 milliards de dollars. Conséquence de cette ambition revue à la baisse : le lancement d'une mission robotique martienne de retour d'échantillons est repoussé de 2003 à 2005.

● **RETOUR :** Le chercheur Philip Christensen, de la mission Global Surveyor, révèle que la sonde entrée en orbite le 11 septembre autour de la planète rouge est porteuse d'un échantillon de la taille d'un grain de sable extrait... d'une météorite martienne recueillie sur Terre.

● **CHINE :** Les morceaux d'une fusée Longue Marche 3B lancée en août dernier seraient retombés sur un village de la province de Hunan, à 1000 km de la base de Xichang.

● **CONSISTANCE :** L'observation du produit de deux cents millions de collisions provoquées au laboratoire de Brookhaven indique que les gluons sont des particules massives, au même titre que les quarks, et non seulement des vecteurs d'interaction nucléaire faible.

● **FRACTION :** Depuis Robert Millikan (1910), on pensait que c'était impossible. Une expérience de physique quantique a permis de créer une quasi-particule dont l'état de charge se mesure par un nombre fractionnaire. Autrement dit, sa charge électrique se distingue de tout multiple entier de la charge de l'électron.

● **CINÉ :** Iouri Kara envisage de réaliser à bord de la station Mir un film intitulé *Le vol dans l'espace a un prix*. Les négociations sont engagées avec la RKA. Mais les deux acteurs principaux tout d'abord pressentis, Emma Thompson et Willem Dafoe, ont refusé.

Deep Space 1 vise juillet 1998

La Nasa poursuit son effort de mise au point d'une douzaine de nouvelles technologies pour une mission à haut risque qui sera lancée en juillet 1998 par une fusée Delta de classe moyenne-légère. Deep Space 1, sonde de 830 millions de francs, devrait notamment être dotée de propulseurs ioniques alimentés en énergie par un réseau de lentilles qui lui fourniront 2,6 kW de puissance électrique. Elle devrait ainsi pouvoir s'approcher à 5 km de l'astéroïde McAuliffe (janvier 1999), puis exploiter l'assistance gravitationnelle de Mars (avril 2000) et survoler la comète West-Kohoutek-Ikemura en juin 2000. La sonde sera par ailleurs programmée pour se guider sur un échantillon de 250 000 étoiles repères. Elle possèdera en outre un instrument de 12 kg jouant à la fois le rôle de caméra optique et de spectromètre sensible dans l'ultraviolet et l'infrarouge. ■

rocks. Thousands of tons of this isotope could be scraped from the Moon's surface and returned to Earth. Future fusion reactors could use deuterium and helium-3, with less dangerous radioactive by-products generated in the walls of the reactor. The Moon thus potentially contains the fuel for the world's needs for millennia.

The Moon also offers a very large platform for work. Its far side is shielded from the Earth and constitutes a radio-quiet zone in which radio interferometers can work without interference from signals made on Earth.

The lunar surface is more stable than the Earth's, with less intrinsic seismic activity, so the mirrors of optical and millimetre-wave interferometers shake less. The search for gravitational radiation could be carried out more easily from the Moon because the slight changes in the positions of the mirrors caused by gravitational waves would be more readily detected. Additionally, it is possible to build large telescopes in the low gravity of the Moon, and their view of the sky would be atmosphere free.

However, this is the optimistic view of the use of the Moon for astronomical investigation. Dust on the lunar surface makes operation of machinery and mirrors problematic.

It is true the Moon has little intrinsic seismic activity but it is frequently struck by meteorites which cause the Moon to 'ring', generating a background of spurious noise signals.

The day/night thermal range makes large structure expand and contract more than on Earth.

Thus, on reflection, ESA astronomers who studied the possibilities for the detection of gravitational radiation, rejected the Moon as a base in favour of a free-flying interferometer, especially considering the cost (many tens of billions of dollars for a lunar colony, several hundred millions of dollars for the gravitational wave interferometer experiment known as LISA).

Space shuttle Endeavour in the Vertical Assembly Building. Photo: NASA.

Mars

Mars is very like the Earth, and there are convincing reasons for its study and exploration, not the least of which is the possibility that life exists or has existed there.

The study of Mars is interesting for its own right, and also because the study of Mars is the study of ourselves. But the practical reasons for manned exploration of Mars are not convincing. There are extreme resource demands for a two year journey to Mars and back (one way trips are cheaper but there are few volunteers). As brilliantly demonstrated by this year's Pathfinder mission, the studies that have been envisaged can be carried out by robotic exploration rather than by people, at least for the foreseeable future.

Space station utilisation

In the same way, the results from the manned space stations are disappointing. The life-support systems themselves deteriorate the scientific environment (by causing vibration) for some of the most sensitive experiments (e.g. material science experiments in microgravity). Because of the astronauts and their life support mechanisms, the microgravity environment is not so micro as all that, and free flying spacecraft provide better scientific opportunities for materials science.

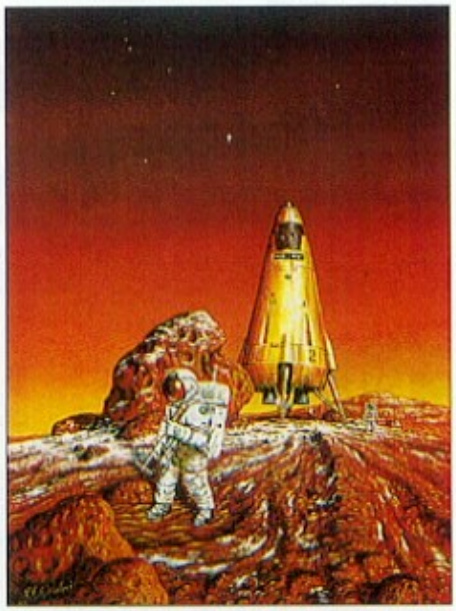
Astronomers considering the use of ISS have been unimpressed because astronomical telescopes based on it are restricted in what they can see, due to the ISS structure and the angle subtended by the Earth. The scientific return does not therefore seem to justify the additional cost necessary to provide life support systems and safety, although the first calls for proposals have only just been made, and the community could rise to the challenge.

The most imaginative proposal which I have seen is to use ISS as an assembly area, putting together a large X-ray telescope far too big to be made and launched in the shuttle or a single rocket cargo bay. Perhaps the best uses will be made in the technology area, making large and perfect protein crystals for analysis of their molecular constitution by X-ray crystallography, improving casting techniques etc.

The human factor

Human beings think and can react to unplanned situations. So astronauts can repair equipment or improvise around problems (as with the Hubble Space Telescope, or Apollo 13). This is balanced by the difficulties that the astronauts themselves cause by operating equipment incorrectly, in the stress of an unfamiliar situation.

In July 1997 the results of human intervention could be seen, when Mir collided with a supply spacecraft under manual control and, in carrying out consequent repairs, an astronaut accidentally disconnected an essential cable causing Mir to shut down.



Will people ever explore Mars? An artist's impression by Peter G. Goodwin.

The future

There are certainly geo-political reasons for participation in space stations. The construction of large space stations is something which can be carried out only on a global basis. The countries of the world have to co-operate. This is seen in the ISS project, where the USA, Russia, Japan and Europe work together. The main funding, however, is from the USA, and controlled politically from the White House: when the USA and Russia meet at a high level to discuss ISS, Vice-President Gore meets Prime Minister Chernomyrdin.

Building the International Space Station is reckoned to be better for the world than cold war competition. This dovetails with the perspective on the exploration of space by the United Nations, whose space treaties define astronauts as envoys of humankind, and call for the use of space to be peaceful and international.

To justify space stations in the long run, they have to be seen as a step towards the long term colonisation of space, gathering knowledge and experience about the practicalities of living in space – part of the future history of humankind. Experiments on human biology and psychology have produced unique results and experience towards developing systems for people to survive longer and longer periods in space. Mir and ISS are the first steps towards the Moon, Mars and beyond – whenever in the distant future of human history that will become desirable, necessary, and/or affordable.

Paul Murdin is Head of Astronomy at PPARC and Director of Science at BNSC, with an astronomer's perspective on spaceflight.

to Saturn, any surface liquid is going to slosh backwards and forward: tides. This implies a dissipation of energy by tidal friction, which means the circularisation of the orbit. So we need an ocean to explain the methane; but with a big ocean, there should be a circular orbit.

Because of this paradox the mission planners don't know what they are sending Huygens into. They have designed the heroic little probe to float, or sink in a less dense ocean, or to land in slush.

Some suggest the most likely resolution is that Titan is like a flooded Moon: pocked by circular crater lakes. Despite its thick atmosphere, Titan's surface must be covered with impact craters, up to a couple of hundred kilometres across. Perhaps the crater floors are filled with liquid hydrocarbons. The crater seas may be big enough to serve as methane reservoirs, but in bodies of fluid that size the tidal friction should be negligible.

Wherever the explorers land will look superficially the same, under the universal haze. The atmosphere is so thick that the temperature scarcely varies, from pole to pole. What the explorers will seek – for the purposes of science, and so they can supply their own needs – is an interface between geologic units: an area where several different types of terrain come together.

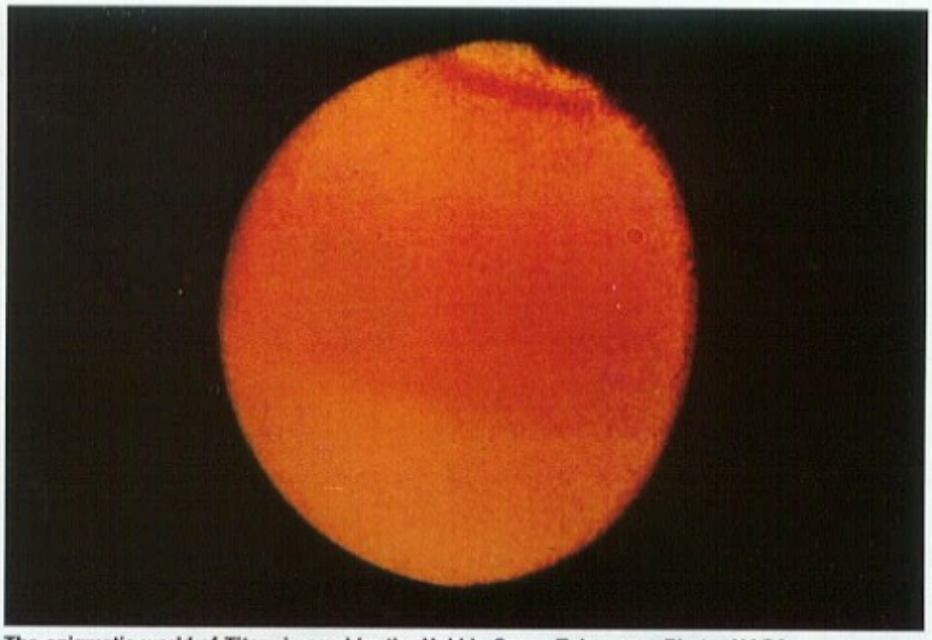
The 'coastline' of the big continent may be suitable for a first landing, especially if there is a mountain range nearby. The lowlands are covered in tholin slush, but there is rain, of ethane and methane. The huge, slow-moving droplets evaporate before they reach ground level. But the rain should wash the tholins off the elevated ground. So the peak of the mountains will be exposed water ice.

The explorers will find that Titan is not like Earth. Its 'bedrock' is water ice, with a little silicate: at these temperatures, water ice is very hard. The explorers may see methane geysers, plate tectonics, even volcanoes. But these are driven by ammonia-water processes, deep in the icy mantle: cryovulcanism. So on Titan, the bodies of the explorers will be hundreds of degrees hotter than molten lava...

Science and Life

Why go to Titan? The primary motivation must be its scientific interest.

The first living things on Earth were cruder than the most humble microbe alive today – just barely able to make copies of themselves. But those first creatures came to be on a lifeless world, made of bits and pieces of organic molecules, which must, of course, have formed on a pregenesis Earth. Of all the possible organics only a few are used at the heart of life: the most important are amino acids, the building blocks of proteins, and nucleotide bases, the building blocks of nucleic acids.



The enigmatic world of Titan, imaged by the Hubble Space Telescope. Photo: NASA.

To understand these antique processes we need to study a world like primeval Earth: a world retaining hydrogen-rich gases, forming organic building blocks, but still operating in our own time. Titan is just such a world.

Titan's deep cold has a number of subtle effects. The higher the temperature, the faster molecules fall to pieces. On Titan, even the oldest organic molecules might still be present, in the deepest slush layers: thus, Titan's surface is coated in deep-frozen primeval soup.

So Titan, at the very least, will be a fascinating organic chemistry laboratory, offering us a deep insight into the fundamental processes which shaped life on Earth. But perhaps there is more. Perhaps there is even life there.

Titan right now is like primeval Earth. But there's a crucial difference: Titan has no liquid water – it is simply too cold. On Earth water is needed as a solution medium, so that the prebiotic building blocks can assemble themselves into the macromolecules of our form of life.

But there are other possible solvents: in particular, ammonia. We know that there is ammonia on Titan, probably in liquid form in ancient deep-buried oceans. It is possible, on paper, to put together an analogy of Earth life processes with ammonia everywhere replacing water. Titan life would breath nitrogen to burn methane, as we burn sugars in oxygen, and exhale cyanogen as we exhale carbon dioxide.

On Titan, the air is so thick and the gravity so light that humans will be able to fly freely, under their own muscle power: people will fly, on Leonardo wings.

Some scientists argue that Titan is the most promising abode of life beyond Earth itself. And perhaps the first explorers will be trained to look for crystals of cyanogen, the telltale signs of Titan life.

Outpost to the future

Beyond its scientific value, what use is Titan? Titan may be a key resource in our future exploration and development of the Solar System. It is an organic-synthesis machine, way off in the outer Solar System, which can be tuned to serve Earthly life. It could become a factory, churning out fibres, food, any organic-chemistry product: even CHON food, manufactured from carbon, hydrogen, oxygen, nitrogen. Generally the comets have been suggested as an off-Earth resource for such raw materials. Titan is a lot closer than most comets, and has vastly more mass besides. Colonies there should soon be self-sufficient, and may export foodstuffs to other colonies, to the inner planets, even to Earth itself.

Further out in time, it may be possible to export Titan's volatiles to inner planets lacking them. An Earth-like biosphere needs nitrogen. Mars, for example, has no nitrogen; Titan has plenty, and it would be relatively easy extracted from the moon's shallow gravity well. Thus, Titan nitrogen could be used to terraform Mars.

Titan – cold, dark and remote – may seem a less obvious candidate for colonisation than the Moon or Mars. But the Moon is dead, Mars deep-frozen; and only on Titan can we detect, in the present day, the complex organic chemistry which characterises Earth. A beachhead on Titan could be the key to the mysteries of our own past, to the outer solar system – even to the stars.

Stephen Baxter is the author of eight science fiction novels published in the UK by HarperCollins. His latest novel, *Titan*, is about a mission to Titan.

Couverture : Manchu/C&E

ÉDITORIAL

Quelle année ! En ce qui concerne l'astronomie et l'espace, 1997 restera un grand millésime. Après le passage printanier de Hale-Bopp, que l'on peut désormais sans risque qualifier de comète du siècle, c'est la planète rouge qui a occupé le devant de la scène tout l'été, avec le spectaculaire reportage en direct que nous a offert Mars Pathfinder. Joli succès pour une aussi modeste mission scientifique. Le Jet Propulsion Laboratory, dont nous vous proposons ce mois-ci la visite, a encore du pain sur la planche : remettre sa sonde Mars Global Surveyor, handicapée par un panneau solaire de guingois, sur une bonne orbite. Des soucis qui n'empêchent pas les Américains de nous promettre maintenant l'homme sur Mars pour 2011. Coup de bluff ou véritable défi ? C'est le sujet de notre dossier ce mois-ci. 1997, encore, c'est l'Europe spatiale qui relève la tête, avec un sans faute de la fusée Ariane 5, garante de son indépendance vis-à-vis d'amis américains parfois un peu encombrants... Enfin, plus modestement, 1997 a aussi été une année exceptionnelle pour votre magazine. En vous proposant davantage de pages, donc plus d'articles, en suivant au plus près le fil de l'actualité, nous avons recueilli vos suffrages : c'est quelque dix mille nouveaux lecteurs que nous sommes désormais heureux d'accueillir tous les mois. À chacun d'entre vous, toute notre équipe souhaite de bonnes fêtes !

Serge Brunier

Sommaire

N° 331 - DÉCEMBRE 1997

La Nasa relance l'homme sur **Mars**

Jean-Paul Dufour

On ne prendra pas au dépourvu la première puissance spatiale de la planète. La Nasa a toujours en réserve un grand programme à offrir en ligne de mire au reste du monde. Dernier en date : l'homme sur Mars en 2011. Au-delà de la crédibilité des calendriers et des obstacles qui s'opposent encore à une telle entreprise, la Nasa prend date.

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Fêtes : des **cadeaux** tombés du ciel

Nathalie Bucsek

Les fêtes approchent et, cette année, *Ciel et Espace* a décidé de les placer sous le signe des astres en vous proposant une sélection inspirée des étoiles. Véritables objets d'art ou cadeaux à petits prix, ils ont en commun... leur touche astronomique. Beaux livres, romans ou CD-Rom coups de cœur, ils ont une même vocation : faire naître, ou attiser, la passion.

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Internet : les étoiles de la Toile

Éric Dupin

Où trouver la dernière image de la sonde Galileo ? Le calendrier de lancement d'Ariane ? Les éphémérides du mois en cours ? Facile : sur le Web. Le ciel et l'espace se sont taillé une jolie place sur le réseau des réseaux. Un foisonnement de sites, une toile dans la Toile. Nous avons choisi pour vous quelques exemples parmi cette multitude.

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di fiumi, laghi, mari?

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As Popular Science celebrates its 10th annual "BEST OF WHAT'S NEW,"

we invite you to consider this remarkable year in science and technology. The year 1997 is when the first animal was cloned and the rover Sojourner discovered the wonders of "Barnacle Bill" and other martian features. More down-to-Earth technologies are no less noteworthy: Digital cameras exploded with fantastic shapes and new capabilities. The long-promised hang-on-the-wall TV display arrived. And the first car with a hybrid drive—a gasoline engine and electric motor—is now in production. Popular Science's editors celebrate these and other outstanding achievements—a total of 100 in all. There are also 10 grand awards, one in each of 10 categories. After you've seen the editors' choices, tell us yours: Cast a vote on our Web site for your favorite item, **www.popsci.com**

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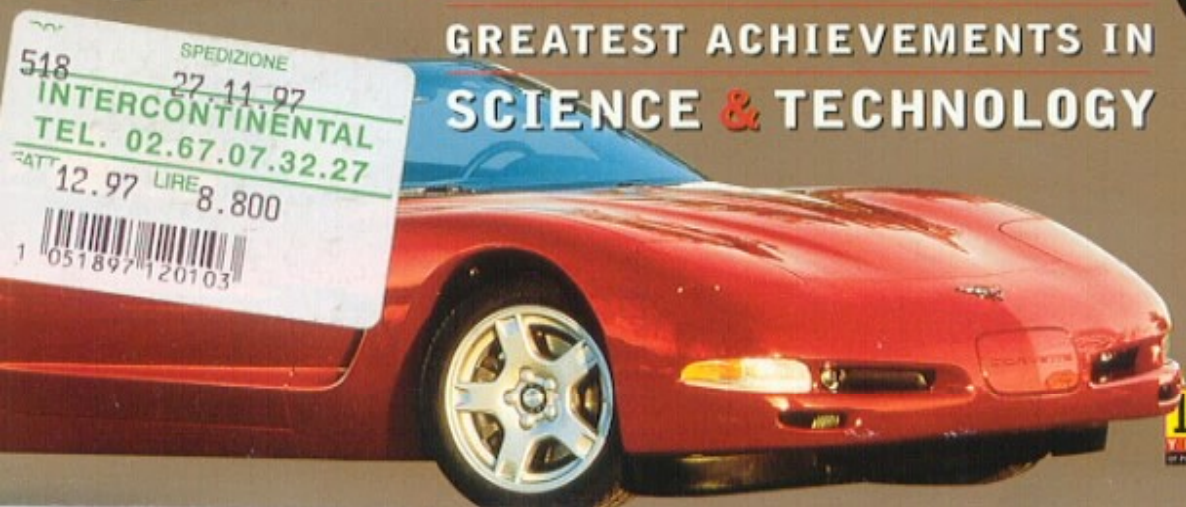

SPEDIZIONE
518 27.11.97
INTERCONTINENTAL
TEL. 02.67.07.32.27
12.97 LIRE 8.800
1 051897 120103

DECEMBER 1997 $2.99
CANADA $3.99
A TIMES MIRROR MAGAZINE
www.popsci.com
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CELEBRATING 125 YEARS of POPULAR SCIENCE

Quelle place pour L'HOMME dans L'

Vols habités ou vols automatiques ? La controverse fait rage depuis les débuts de l'ère spatiale. Mais, aujourd'hui, les restrictions budgétaires imposent à la France et à l'Allemagne de choisir l'intérêt scientifique plutôt que le prestige.

PAR GERMAIN CHAMBOST

Interrogé en septembre dernier sur la politique spatiale, le ministre de l'Enseignement et de la Recherche, Claude Allègre, n'a pas fait dans la dentelle. Pour lui, les vols habités «sont une fausse route. [...] Les Américains essaient de nous amarrer à la station internationale. [...] Pourquoi Ariane 5 ne lancerait-elle pas une sonde vers Mars?»

Encore cette analyse du ministre se situe-t-elle nettement en retrait des fracassantes déclarations du scientifique, en février 1996. Claude Allègre qualifiait alors les vols habités de «manèges absurdes dont on ne perçoit ni l'intérêt scientifique ni l'intérêt humain». Quant à la participation de l'Europe à la future station internationale *Alpha*, dont le budget actuel s'élève à 90 milliards de francs, il la jugeait ainsi : «Fascinée par l'Amérique, même dans la stupidité, l'Europe emboîte le pas.»

Sa prise de position rejoint celle d'André Lebeau, ancien président du Centre national d'études spatiales (CNES), qui considérait naguère que l'engagement français (et européen) dans la station *Alpha* était une erreur. Désavoué par les pouvoirs publics, Lebeau avait rendu son tablier.

L'opinion d'Allègre est également partagée par un grand nombre de scientifiques – pour ne pas dire leur quasi-totalité – qui déplorent le gâchis financier des vols habités. «Je rejoins le point de vue de Claude Allègre», déclare ainsi Hubert Curien, ancien ministre de la Recherche, «même si cela ne m'empêche pas d'admirer Jean-Loup Chrétien et Claudie André-Deshays, nos spationautes. Ce ne sont pas eux qui sont en cause. Mais il faut faire des choix budgétaires. Et les perspectives qu'offre la robotique spatiale – par exemple, l'envoi d'une sonde automatique vers Mars – sont autrement attrayantes, en termes scientifiques, que des séjours en orbite. L'argent investi sera bien mieux employé, et les retombées, d'une tout autre ampleur.»

SCIENTIFIQUES CONTRE POLITIQUES

Entre les vols habités autour de la Terre et l'envoi de robots vers Mars, il donc faut choisir. On dira que le débat n'est pas nouveau, qu'il date même des débuts de la conquête spatiale. Les astronomes et les géophysiciens se sont presque toujours opposés aux industriels et à la plupart des po-

SUCCÈS automatique

Le succès scientifique et médiatique de la mission du robot *Sojourner* sur Mars conforte les partisans des engins automatiques pour l'exploration spatiale.

Wings, springs and flying chariots

Our technological present is yesterday's science fiction. Allan Chapman **looks back at space travel, seventeenth century style.**

In a time like our own, when spaceflight has become an established reality, and many people believe that alien creatures from space are flying in their saucers across our skies, it is all too easy to forget that it has all been said before. For the Space Age, one might plausibly argue, was not born in the 1950s but in the 1610s, when western science first came to grasp the implications that lay behind the first telescopic discoveries.

Galileo and his contemporaries, with their simple spyglasses, had shown that the Universe was a radically different place from what Ptolemy and the ancients had believed it to be. By 1610, Galileo had shown that the Moon possessed mountains, continents and 'seas', while his telescope revealed that, instead of being moving stars, Venus, Mars, Jupiter and Saturn were spherical balls of great size. In short, they were *worlds*, just like planet Earth.

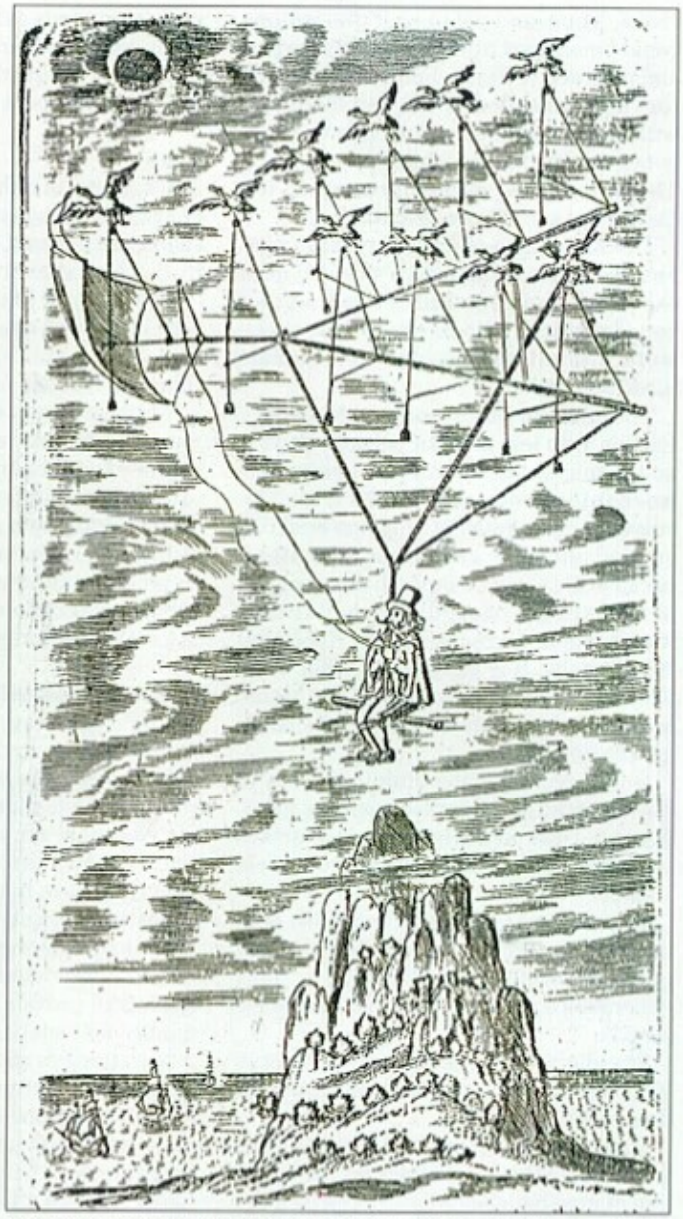
And as the telescope revealed myriads of new stars invisible to the naked eye, and many scientists by 1630 felt convinced that the Earth moved around the Sun, it was thought highly likely that planets encircled many of the stars themselves.

Between the time when Galileo first looked at the Moon in 1610 and his death in 1642, the Universe had become an immeasurably vaster, more complicated, and more heterogeneously-populated place than anybody in 1600 could possibly have imagined.

A clockwork world

In these heady early days of scientific discovery other, non-astronomical wonders were also on the move. There were more machines and mechanical inventions than ever before: locks and keys, guns, windmills, ocean-going ships, and wind carriages that crossed the drained Dutch polders at a rate of 30 miles per hour.

"That there is a Worlde in the Moone, and that it is possible to travel thither by means of Flying Chariots". Dr John Wilkins, 1640.



Domingo Gonsales heads for the Moon, carried by his Ganzas. From F. Goodwin's *The Man in the Moone* (1657). Courtesy: Warden and Fellows of Wadham College.

But most enchanting of all was clockwork, whereby a wound-up spring acting through a train of gears could not only be made to tell the time, but to make self-propelled toy vehicles move across the floor or cause a pair of feather-covered wings to flap. If only such devices could be scaled up, could they not carry a man up into the air – and on to the Moon?

First 'science' fiction

Johannes Kepler was not only one of the founding fathers of modern astronomy, but the first true science fiction writer who wrote a fantasy story about a voyage to the Moon, which was published posthumously in 1634. Now while it is true that earlier authors had written about lunar voyages, their purposes had been political or social satire, where they fantasised about a perfect state of lunar government. Where Kepler was so innovative, however, was in his stress on the science.

Kepler's lunar voyager had to break free from the Earth's pull with such force that the demons that very obligingly propelled him upwards gave him a sedative to minimise the shock. To stop the Sun's light from blinding him in space, he was blasted aloft during a total eclipse, where he travelled up the Moon's shadow.

The 'Selenites', or lunar inhabitants, were smaller than humans, because their world was correspondingly smaller than Earth, and after his adventures on the Moon, with its 14-day cold nights and

l'origine de la chute de l'URSS, qui s'est épuisée financièrement à vouloir suivre le mouvement.

Daniel Goldin, qui effectuait une tournée européenne en octobre, est accusé par certains de vouloir *"diviser les Européens"*. Il a déjà proposé une participation aux vols humains vers Mars aux Italiens, qui semblent tentés. Il a rencontré le ministre de la Recherche français. Ce dernier, qui affiche clairement sa réticence pour les vols humains, se dit, en revanche, très intéressé par une coopération avec les Américains sur les missions automatiques d'exploration martienne. Quant aux Allemands, ils lui ont indiqué que ce genre de missions *"n'est pas une priorité"* pour eux et qu'ils préfèrent se consacrer à *"l'espace utile"*.

L'Europe pourra-t-elle résister longtemps ? La puissance américaine n'est pas seulement technologique. On a vu la Nasa mettre en branle une formidable machine médiatique autour de ses projets martiens. Commencée avec la popularisation d'une découverte, très contestée des scientifiques, de possibles traces de vie sur une météorite d'origine martienne, la campagne a rebondi sur la diffusion planétaire, avec un luxe de détails, des moindres exploits du robot Sojourner. Elle va continuer. Sera-t-il possible de résister à un tel rouleau compresseur ?

Peut-être pas. Mais, de toute façon, *"on se trompe d'une génération*, lance Gérard Brachet, directeur général du Cnes. *Il faut être clair : aucun homme ne devrait mettre le pied sur Mars avant 2030 au plus tôt."* D'ici là, les technologies auront progressé et les vols habités auront peut-être gagné en intérêt. Mais G. Brachet ne se fait guère d'illusion : *"Comme pour la station Alpha, l'Europe risque de n'obtenir qu'un strapontin."* Certes, souligne-t-il, *"il y a des strapontins intelligents"*. Des éléments *"visibles"*, indispensables au fonctionnement de l'ensemble et qui impliquent le développement de technologies nouvelles dans des domaines nouveaux. C'est le cas du bras télémanipulateur fourni par le Canada. Cela aurait pu être le cas du CRV, le véhicule de secours proposé par la France [1]. Mais ce n'est pas le cas du module européen COF, qui ne sera qu'un "bidon" parmi d'autres sur la station et *"ne met en jeu que des technologies maîtrisées depuis longtemps par l'Europe"*, estime Gérard Brachet.

> ***"Le sport : c'est la seule raison, mais c'est une raison forte"***

Reste la question fondamentale: à quoi ça sert ? Les douze Américains qui ont foulé le sol lunaire dans le cadre du programme Apollo n'ont pas été suivis. Aucune puissance spatiale n'envisage de retourner sur la Lune avant longtemps.

L'exploration martienne restera-t-elle, elle aussi, un exploit inutile ? Sans doute : son intérêt scientifique est très limité et l'environnement de la planète rouge ne se prête guère à l'installation de colonies permanentes. *"Mais nous irons, vous verrez*, s'enflamme Hubert Curien. *L'humanité ne résistera pas à un tel défi. le contraire prouverait la faillite des ambitions terriennes."* L'utilité de ce genre d'expédition ? *"Le sport, voyons. C'est la seule raison, mais c'est une raison forte. Le sport est une activité à caractère gratuit qui intéresse une part considérable de nos contemporains."* ■

(1) Paradoxalement, la France vient d'annoncer qu'elle ne financerait plus le CRV et qu'elle se retirait de ce programme.